IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, ex rel, W. A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA, and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA, Plaintiffs, vs. TYSON FOODS, Inc., TYSON POULTRY, INC., TYSON CHICKEN, INC., COBB-VANTRESS, INC., AVIAGEN, INC., CAL-MAINE FOODS, INC., CAL-MAINE FARMS, INC., CARGILL, INC., CARGILL TURKEY PRODUCTION, LLC, GEORGE'S, INC., GEORGE'S FARMS, INC., PETERSON FARMS, INC., SIMMONS FOODS, Inc. WILLOWBROOK FOODS, INC. Defendants.	Case No. 4:05-cv-00329-GKF-SAJ

EXPERT REPORT OF VALERIE J. HARWOOD, Ph.D.

surface and ground water quality as microorganisms move with surface and subsurface water flow (U.S. Environmental Protection Agency, 2005a). Broiler production generates large amounts of contaminated litter, i.e. up to 0.5 pounds of soiled litter per pound of meat produced, or 340 tons annually from a farm with only four houses (Dozier, Lacy & Vest, 2001). Used poultry litter is known to contain high levels of indicator bacteria. Contaminated poultry litter samples were collected by CDM from poultry houses in the IRW in 2006 (Camp Dresser & McKee (CDM), 2008). Ten samples, each from a different facility, were tested for indicator bacteria levels and for a poultry-specific biomarker (the biomarker is discussed in the Microbial Source Tracking Section below). The indicator bacteria concentrations in these samples were generally extremely high, with a geometric mean of ~1200 *E. coli* per gram of litter, and ~51,000 enterococci/g litter. The maximum levels for both indicator bacteria from any one location were over 100,000/g litter (Camp Dresser & McKee (CDM), 2008). *Salmonella* was detected in four of 24 contaminated poultry litter samples (16.7%), but *Campylobacter* was not detected by the culture-based methods used. More sensitive PCR methods that could detect viable but nonculturable pathogens would have been more suited to the detection of pathogens such as *Salmonella* and *Campylobacter* in poultry litter and environmental samples. Given the near-ubiquitous association of these pathogens with poultry feces, my opinion is that these pathogens were present, but that too few were present in a culturable state to be detected by the methods used, which were developed for the food industry and not for environmental samples where pathogens are physiologically stressed.

32. The anticipated pathway of surface water contamination from land-applied poultry litter would begin with runoff from the edges of fields on which litter had been spread. "Edge-of-field" samples collected by CDM in the IRW typically had very high levels of indicator bacteria (Camp Dresser & McKee (CDM), 2008). Some samples had *E. coli* levels of over 1 million/100 ml, which approaches the concentration found in raw sewage (Harwood et al., 2005). Soil samples collected from fields on which poultry litter had been land-applied as levels of up to 2,000 *E. coli* per gram of soil and 17,000 enterococci/g. As expected, IRW surface water samples had variable indicator bacteria levels; however, chronic exceedances of the primary body contact standard for bacteria levels were recorded throughout the IRW (detailed in Teaf, 2008). The data indicate that human exposure to fecal bacteria is occurring since the exceedances also occurred frequently at established "put-in" spots along the IRW, where people enter the water to swim, float, canoe or kayak.